

IN THE CLAIMS

1. (canceled)

2. (currently amended) The watercraft of claim 55 ~~claim 1~~ wherein said wings are adapted to move with their trailing edge upwards to submerge said watercraft at said dive speed and retain the submerged condition at a submerged speed.

3. (currently amended) The watercraft of claim 55 ~~claim 1~~ in which said wings have movable trailing edge flaps which are adapted to move upwards to generate a downward hydrodynamic force and downwards to generate a lifting force.

4. (canceled)

5. (canceled)

6. (canceled)

7. (currently amended) The watercraft of claim 55 ~~claim 6~~ in which the span of said flap is approximately equal to the beam at the rearward end of said elongated body.

8. (original) The watercraft of claim 7 with the chord of said flap being no less than approximately 2.5% of the length of said elongated body.

9. (canceled).

10. (canceled).

11. (canceled).

12. (canceled).

13. (currently amended) The watercraft of claim 55 claim 6 in which said trailing edge flaps and said wings are adapted to be moved in coordinated fashion to accomplish pitch and path

1 control, with the trailing edge of said flap moving in opposite direction to the trailing edges of said
2 wings.

3

4 14. (currently amended) The watercraft of claim 55 ~~claim 6~~ in which the trailing edge
5 of said flap and said wings are adapted to be moved in the same direction to accomplish changes in
6 heave.

7

8 15. (canceled).

9 16. (canceled).

10 17. (canceled).

11 18. (canceled).

12 19. (canceled).

13 20. (canceled).

14 21. (canceled).

15 22. (canceled).

16 23. (canceled).

17 24. (canceled).

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19 25. (currently amended) A surface and subsurface operational watercraft comprising:

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21 a watercraft hull including;

22

23 a generally triangular water-engaging section including a pointed bow, horizontally extended stern,
24 a midbody region, and generally straight side walls extending divergently from said bow to
25 said stern; and with the water beam at said extended stern substantially larger than the water
beam of said midbody region; and a generally pyramidal surface section atop said water
26 engaging section extending generally rearwardly from said water engaging bow having left
27

1 and right forward wall sections each respectively extending from and engaging the upper
2 edges of one of said side walls and a rear wall section extending upwards from said stern;
3 and

4
5 at least two attitude-adjustable water-engaging wings each mounted on and extending outwards from
6 a respective one of said side walls of said water-engaging section, said wings operative to
7 control submersion of said watercraft during movement of said watercraft via attitude
8 adjustment thereof.

9
10 26. (currently amended) The watercraft of claim 25 wherein in a surface operational
11 condition said bow has a substantially deeper draft than said stern.

12
13 27. (canceled)

14
15 28. (currently amended) The watercraft of claim 41 wherein

16
17 a) The weight of the water volume displaced by the watercraft when fully submerged is
18 substantially larger than the weight of the watercraft;:-

19
20 b) Right and left wings are provided extending laterally outboard of the sides of said elongated
21 body when said watercraft has forward motion in submerged operation, said wings being
22 capable of providing a downward force at least approximately equal to the difference
23 between said ~~water~~ weight of said water volume and the weight of said watercraft;:-

24
25 c) With said wings continuing to provide said downward force for continuous submerged
26 operation; and:-

1 d) With a movable trailing surface mounted on said narrow rear end having a horizontal span
2 substantially larger than the beam of said midbody region.

3
4 29. (canceled)

5
6 30. (previously amended) The watercraft of claim 25 further characterized in that a
7 traverse trailing edge flap is provided adjacent said stern, with said flap being deflected with its
8 rearward trailing edge down when in forward motion to cause said vessel to lower its pointed bow,
9 and deflected with its rearward edge up to cause said watercraft to raise its pointed bow upwards.

10
11 31. (original) The watercraft of claim 30 further characterized in having a
12 powerplant and in that for a given position of wings and flap when operating submerged, depth
13 control below water is controlled in steady submerged navigation by changes in power level of said
14 powerplant.

15
16 32. (canceled).

17 33. (canceled).

18 34. (canceled).

19 35. (canceled).

20 36. (canceled).

21 37. (canceled).

22 38. (canceled).

23 39. (currently amended) The watercraft of claim 63 claim 38 wherein said triangular
24 profile in side view is modified to be polygonal above the water plane, with the principal surfaces
25 of said upper body portion being faceted between planview and profile.

26
27 40. (currently amended) A surface and subsurface operational watercraft having an

1 elongated body with a forward end which is approximately wedge-shaped in planview with its
2 narrow end forward, a midbody region having right and left lateral surfaces and a bottom surface
3 extending between said right and left lateral surfaces, and a rearward end which is approximately
4 wedge-shaped in profile view with its narrow end rearward; said elongated body further
5 characterized in having in sideview, a total height between top and bottom surface portions of said
6 elongated body adjacent said forward end which is substantially less than the total planform width
7 between right and left side surface portions of said elongated body adjacent said rearward end, said
8 total planform width of said rearward end being greater than any selected planform width of said
9 midbody region, with the height in profile of said midbody region being substantially larger than said
10 total height adjacent said forward end.

11

12 41. (currently amended) A surface and subsurface operational watercraft having an
13 elongated body with a forward end which is approximately wedge-shaped in planview with its
14 narrow end forward, a midbody region having right and left lateral surfaces and a bottom surface
15 extending between said right and left lateral surfaces and a rearward end which is approximately
16 wedge-shaped in profile view with its narrow end rearward; said elongated body further
17 characterized in having in sideview a total height between top and bottom surface portions of said
18 elongated body adjacent said forward end no greater than approximately half the total width between
19 right and left side surface portions of said elongated body adjacent said rearward end, with the
20 principal surfaces of said watercraft being generally free of twist.

21

22 42. (canceled).

23

24 43. (previously amended) A surface and subsurface operational watercraft having an
25 elongated body with a forward end which is approximately wedge-shaped in planview with its
26 narrow end forward, a midbody region having right and left lateral surfaces and a bottom surface
27 extending between said right and left lateral surfaces, and a rearward end which is approximately

1 wedge-shaped in profile view with its narrow end rearward; said elongated body being further
2 characterized in ink that the included angle in profile of said rearward end is substantially greater
3 than the included angle in planview of said forward end, the total planform width between left and
4 right side portions of said elongated body adjacent said rearward end being greater than any selected
5 planform width of said midbody region.

6

7 44. (previously amended) The structure of claim 40 further characterized in that said
8 elongated body has lateral right and left wing panels to provide substantially vertical forces during
9 said subsurface operation of said watercraft.

10

11 45. (previously added) The structure of claim 40 further characterized in that said
12 rearward end of said elongated body has upper and lower surfaces portions joined in an athwarship
13 rearward border, and in that a movable control surface is mounted on said rearward border.

14

15 46. (currently amended) A surface and subsurface operational watercraft capable of
16 resting stationary at bottom of a water body having an elongated body with a midbody region, a
17 forward end which is approximately wedge-shaped in planview with its narrow end forward, and a
18 rearward end which is approximately wedge-shaped in profile view with its narrow end rearward,
19 said elongated body further characterized in having a height in side view adjacent said forward ends
20 which is substantially less than the width of said elongated body adjacent said rearward end, with
21 a midbody height in side view which is substantially larger than the height in side view adjacent said
22 forward end an overall streamlined surface envelope of said elongated body with a total body
23 volume; a primary interior dry volume having a structural midbody portion capable of supporting
24 external water pressures when submerged; and a secondary interior volume which is adapted to be
25 flooded for stationary resting at the bottom of said water body with equal water pressure between
26 water outside and inside said secondary interior volume.

1 47. (currently amended) The watercraft of claim 43 further comprising a parachute
2 connected adjacent said rearward end, whereby said elongated body is adapted to be air-dropped
3 from an aircraft, said parachute operative to establish an approximately steady decent rate with said
4 forward end pointing towards a water body, said decent rate being no larger than twice a high
5 subsurface speed of said watercraft.

6

7 48. (previously amended) The watercraft of claim 41 further characterized in that said
8 elongated body is adapted for land operation with a retractable tricycle wheel arrangement.

9

10 49. (previously amended) The watercraft of claim 41 further characterized in that said
11 elongated body is adapted to move across a large wave with a transient submerged path below the
12 top of said wave.

13

14 50. (currently amended) The surface and subsurface operational watercraft of claim 25
15 further characterized in having a principal body surface envelope portion above water when in
16 surface operation comprised by several flat panels oriented in a generally streamlined disposition
17 generally free of step discontinuities.

18

19 51. (currently amended) The watercraft of claim 47 further characterized in having a
20 powerplant capable of imparting a forward thrust approximately parallel to the long dimension of
21 said elongated body, with said watercraft being adapted to be released above a water surface
22 suspended from said parachute with said forward end in an approximately downwardly direction,
23 with said powerplant being active to impart forward thrust when said forward end penetrates said
24 water surface, whereby said watercraft can continue to penetrate below said water surface under
25 controlled conditions against upward buoyant forces generated by said watercraft at a high
26 underwater speed no less than approximately one-half of said decent rate.

52. (previously added) The structure of claim 44 further characterized in that said wings are adapted to be moved from a deployed position protruding laterally from said elongated body, to a retracted position in which at least a substantial portion of said wings are positioned in close proximity to said elongated body in a streamlined disposition.

53. (currently amended) A transonic hull having a submerged portion with an approximate triangular static waterplane at water surface, with a bow adjacent its narrow end, and a stern adjacent its broad end; principal right and left side surfaces, and a principal lower surface extending between the lower regions of said side surfaces, said transonic hull being further characterized in having a body above said submerged portion, with said body having:

(a) a forward end adjacent said bow, a rearward end adjacent said stern, a longitudinal length, and a midbody region;

(b) a generally triangular body planform adjacent said triangular waterplane with its narrow portion adjacent said forward end and its broad portion adjacent said rearward end, with said rearward end having an athwartship horizontal width;

(c) a lateral profile in side view with a body height adjacent said midbody region, said lateral profile having a profile height distribution forward of said midbody region which decreases substantially continuously towards said forward end free of radar-reflecting step discontinuities, with a height adjacent said forward end substantially smaller than said body height adjacent said midbody portion;

(d) a profile height distribution rearward of said midbody portion which extends continuously toward said rearward end free of radar reflecting step discontinuities, with a height adjacent said rearward end smaller than said athwartship horizontal width,

1 (e) said body being further characterized in having generally continuous surfaces generally free
2 of twist extending from lateral regions of said body planform to define a body volume above and on
3 sides of said body planform, with horizontal planview sections of said body volume above said body
4 planform generally free of radar reflecting step discontinuities.

5

6 54. (currently amended) The structure of claim 40 further characterized in that said
7 elongated body has a principal ~~submerged~~ surface envelope portion above waterplane comprised by
8 several longitudinal flat panels oriented in an approximately streamlined disposition generally free
9 of step discontinuities.

10

11 55. (new) A surface and subsurface operational watercraft having an elongated body
12 with a forward end and a rearward end, said watercraft being further characterized in having:

13

14 a weight and a power means;

15

16 said elongated body having a planform which is generally triangular with a narrow end forward and
17 a broader portion adjacent said stern with said elongated body when floating in static water
18 having a first submerged volume with a profile in side view which is generally a long triangle
19 with base adjacent said forward end and a narrow end adjacent said rearward end;

20

21 said elongated body having right and left lateral wings;

22

23 said watercraft being capable of operating in, at and below the surface of water;

24

25 said first submerged volume generating an upward buoyant force equal to the weight of said
26 watercraft, with said elongated body having a second volume above said first volume
27 sufficient to permit surface operation of said watercraft with a significant positive reserve

1 buoyancy margin;

2
3 said watercraft being capable of moving forward in water under the action of said power means in
4 an efficient and sustained manner;

5
6 said wings being at least partially submerged when said watercraft is operating at the surface of
7 water at a dive speed;

8
9 said wings at said dive speed operative to generate a downward hydrodynamic force sufficient to
10 overcome the upward buoyant force of said positive reserve buoyancy margin when
11 submerged;

12
13 said wings at a submerged speed operative to generate a downward hydrodynamic force sufficient
14 to counter the lifting forces generated by said second volume when submerged;

15
16 said stern has a broad beam in planview forming the trailing edge of said elongated body;

17
18 with the combined profile shape of said first and second volumes adjacent said rearward end tapered
19 in side view smoothly in a rearward direction with upper and lower surface portions meeting
20 at said rearward end;

21
22 with a movable flap mounted on said rearward end, adapted to be moved downwards to selectively
23 dive said watercraft and pitch down said watercraft, and upwards to selectively climb
24 towards the water surface and pitch up said watercraft.

25
26 56. (new) A surface and subsurface operational watercraft comprising:

1 a watercraft hull including;

2

3 a generally triangular water-engaging section including a pointed bow, horizontally extended stern

4 and generally straight side walls extending divergently from said bow to said stern; and

5

6 a generally pyramidal surface section atop said water engaging section having left and right forward

7 wall sections each respectively extending from and engaging the upper edges of one of said

8 side walls and a rear wall section extending upwards from said stern; and

9

10 at least two attitude-adjustable water-engaging wings each mounted on and extending outwards from

11 a respective one of said side walls of said water-engaging section, said wings operative to

12 control submersion of said watercraft during movement of said watercraft via attitude

13 adjustment thereof;

14

15 said wings have a hydrodynamic wing force center when submerged;

16

17 a first watercraft center of buoyancy when floating in surface condition;

18

19 and a second watercraft center of buoyancy when in submerged condition;

20

21 with said second center of buoyancy and said hydrodynamic wing force center being located

22 longitudinally away from said first center of buoyancy, and in that a downward

23 hydrodynamic force on said hydrodynamic wings is additive to the gravitational weight force

24 of said watercraft and jointly oppose and tend to equilibrate the total buoyant forces acting

25 on said second buoyancy center.

26

27 57. (new) A surface and subsurface operational watercraft having an elongated body

28

1 with a forward end and a rearward end, said watercraft being further characterized in having:

2

3 a weight and a power means;

4 said elongated body having a planform which is generally triangular with a narrow end forward and
5 a broader portion adjacent said stern with said elongated body when floating in static water
6 having a first submerged volume with a profile in side view which is generally a long triangle
7 with base adjacent said forward end and a narrow end adjacent said rearward end;

8

9 said elongated body having right and left lateral wings;

10

11 said watercraft being capable of operating in, at and below the surface of water;

12

13 said first submerged volume generating an upward buoyant force equal to the weight of said
14 watercraft, with said elongated body having a second volume above said first volume
15 sufficient to permit surface operation of said watercraft with a significant positive reserve
16 buoyancy margin;

17

18 with said second volume being approximately 50% of said first volume;

19

20 said watercraft being capable of moving forward in water under the action of said power means in
21 an efficient and sustained manner;

22

23 said wings being at least partially submerged when said watercraft is operating at the surface of
24 water at a dive speed;

25

26 said wings at said dive speed operative to generate a downward hydrodynamic force sufficient to
27 overcome the upward buoyant force of said positive reserve buoyancy margin when

1 submerged;

2
3 said wings at a submerged speed operative to generate a downward hydrodynamic force sufficient
4 to counter the lifting forces generated by said second volume when submerged;

5
6 whereby said vessel can operate submerged in an efficient and sustained manner.

7
8 58. (new) A surface and subsurface operational watercraft comprising:

9
10 a watercraft hull including;

11
12 a generally triangular water-engaging section including a pointed bow, horizontally extended stern
13 and generally straight side walls extending divergently from said bow to said stern; and

14
15 a generally pyramidal surface section atop said water engaging section having left and right forward
16 wall sections each respectively extending from and engaging the upper edges of one of said
17 side walls and a rear wall section extending upwards from said stern; and

18
19 at least two attitude-adjustable water-engaging wings each mounted on and extending outwards from
20 a respective one of said side walls of said water-engaging section, said wings operative to
21 control submersion of said watercraft during movement of said watercraft via attitude
22 adjustment thereof;

23
24 with the volume of said generally pyramidal surface section being substantially less than the volume
25 of said generally triangular water engaging section.

26
27 59. (new) A surface and subsurface operational watercraft having a elongated body with

1 a forward and a rearward end, said watercraft being further characterized in having:

2
3 a weight and a power means;

4
5 said elongated body having a planform which is generally triangular with a narrow end forward and
6 a broader portion adjacent said stern with said elongated body when floating in static water
7 having a first submerged volume with a profile in side view which is generally a long triangle
8 with base adjacent said forward end and a narrow end adjacent said rearward end;

9
10 said elongated body having right and left lateral wings;

11
12 said watercraft being capable of operating in, at and below the surface of water;

13
14 said first submerged volume generating an upward buoyant force equal to the weight of said
15 watercraft, with said elongated body having a second volume above said first volume
16 sufficient to permit surface operation of said watercraft with a significant positive reserve
17 buoyancy margin;

18
19 said watercraft being capable of moving forward in water under the action of said power means in
20 an efficient and sustained manner;

21
22 said wings being at least partially submerged when said watercraft is operating at the surface of
23 water at a dive speed;

24
25 said wings at said dive speed operative to generate a downward hydrodynamic force sufficient to
26 overcome the upward buoyant force of said positive reserve buoyancy margin when
27 submerged;

1 said wings at a submerged speed operative to generate a downward hydrodynamic force sufficient
2 to counter the lifting forces generated by said second volume when submerged with the area
3 of said wings (S_w) is no less than the area obtained by dividing the buoyant force (L_{br})
4 generated by said second volume when submerged, by the product of the dynamic water
5 pressure q at said submerged speed times a non-dimensional lift coefficient C_L whence $S_w =$
6 $L_{br} / C_L q$ with C_L values no less than approximately 0.3 and no greater than approximately
7 1.5 for unflapped wings, and no greater than 2.5 for flapped wings.

8

9 60. (new) A surface and subsurface operational watercraft having an elongated body
10 with a forward end and a rearward end, said watercraft being further characterized in having:

11

12 a weight and a power means;

13

14 said elongated body having a planform which is generally triangular with a narrow end forward and
15 a broader portion adjacent said stern with said elongated body when floating in static water
16 having a first submerged volume with a profile in side view which is generally a long triangle
17 with base adjacent said forward end and a narrow end adjacent said rearward end;

18

19 said elongated body having right and left lateral wings;

20

21 said watercraft being capable of operating in, at and below the surface of water;

22

23 said first submerged volume generating an upward buoyant force equal to the weight of said
24 watercraft, with said elongated body having a second volume above said first volume
25 sufficient to permit surface operation of said watercraft with a significant positive reserve
26 buoyancy margin;

1 said watercraft being capable of moving forward in water under the action of said power means in
2 an efficient and sustained manner;

3
4 said wings being at least partially submerged when said watercraft is operating at the surface of
5 water at a dive speed;

6
7 said wings at said dive speed operative to generate a downward hydrodynamic force sufficient to
8 overcome the upward buoyant force of said positive reserve buoyancy margin when
9 submerged;

10
11 said wings at a submerged speed operative to generate a downward hydrodynamic force sufficient
12 to counter the lifting forces generated by said second volume when submerged;

13
14 said stern has a broad beam in planview forming the trailing edge of said elongated body;

15
16 with the combined profile shape of said first and second volumes adjacent said rearward end tapered
17 in side view smoothly in a rearward direction with upper and lower surface portions meeting
18 at said rearward end;

19
20 with the profile view of said second volume of said elongated body above water level being
21 approximately a long triangle with long base adjacent at waterplane, and a short triangle
22 height above said waterplane, located in a midbody region of said elongated body.

23
24 61. (new) A surface and subsurface operational watercraft comprising:

25
26 a watercraft hull including;

1 a generally triangular water-engaging section including a pointed bow, horizontally extended stern
2 and generally straight side walls extending divergently from said bow to said stern; and

3
4 a generally pyramidal surface section atop said water engaging section having left and right forward
5 wall sections each respectively extending from and engaging the upper edges of one of said
6 side walls and a rear wall section extending upwards from said stern; and

7
8 at least two attitude-adjustable water-engaging wings each mounted on and extending outwards from
9 a respective one of said side walls of said water-engaging section, said wings operative to
10 control submersion of said watercraft during movement of said watercraft via attitude
11 adjustment thereof;

12
13 with the profile view of said generally pyramidal section having in profile view a long triangular
14 shape with a long base adjacent waterplane and a short height above said waterplane located
15 approximately at midbody of said pyramidal section.

16
17 62. (new) A surface and subsurface operational watercraft comprising:

18
19 a watercraft hull including;

20
21 a generally triangular water-engaging section including a pointed bow, horizontally extended stern
22 and generally straight side walls extending divergently from said bow to said stern; and

23
24 a generally pyramidal surface section atop said water engaging section having left and right forward
25 wall sections each respectively extending from and engaging the upper edges of one of said
26 side walls and a rear wall section extending upwards from said stern; and

1 at least two attitude-adjustable water-engaging wings each mounted on and extending outwards from
2 a respective one of said side walls of said water-engaging section, said wings operative to
3 control submersion of said watercraft during movement of said watercraft via attitude
4 adjustment thereof;

5

6 an overall streamlined external surface envelope;

7

8 a primary interior dry volume having a structural midbody portion capable of supporting external
9 water pressures when submerged; and

10

11 at least a secondary internal volume which is adapted to be flooded when submerged to equalize
12 pressures between water outside and inside said secondary volume.

13

14 63. (new) A surface and subsurface operational watercraft comprising:

15

16 a watercraft hull including;

17

18 a generally triangular water-engaging section including a pointed bow, horizontally extended stern
19 and generally straight side walls extending divergently from said bow to said stern;

20

21 a generally pyramidal surface section atop said water engaging section having left and right forward
22 wall sections each respectively extending from and engaging the upper edges of one of said
23 side walls and a rear wall section extending upwards from said stern;

24

25 at least two attitude-adjustable water-engaging wings each mounted on and extending outwards from
26 a respective one of said side walls of said water-engaging section, said wings operative to
27 control submersion of said watercraft during movement of said watercraft via attitude

1 adjustment thereof; and

2

3 said elongated body having an upper body portion above water level when operating at surface, said

4 upper body portion having an approximately triangular base planform adjacent said generally

5 triangular water engaging section in planform with a forward end; and with generally straight

6 sides free of shoulder curvatures extending divergently from said bow to said stern, with a

7 stern beam substantially larger than a midbody beam, and an approximately triangular profile

8 in side view extending from a location adjacent said forward end to a location adjacent said

9 stern beam substantially free of step discontinuities therebetween.

10

11 64. (new) The watercraft of claim 63 wherein said triangular profile in side view is

12 modified to be polygonal above the water plane, with the principal surfaces of said upper body

13 portion being faceted between planview and profile.

14

15 65. (new) A watercraft having a long body with a substantially triangular waterplane

16 with narrow end forward, lateral sides and a base rearward, with a pyramidal body above said

17 waterplane substantially comprising three generally triangular surfaces, two of which form the lateral

18 surfaces of said pyramidal body with the forward edges of said lateral surfaces joined above said

19 waterplane in a longitudinal edge which in side view is inclined upwards towards the rear, with the

20 third surface joining the rearward edges of said lateral surfaces and a portion of said long body which

21 is adjacent said base of said waterplane, with said third panel in side view being inclined upwards

22 towards the front.

23

24 66. (new) The structure of claim 65 in which said lateral surfaces are substantially flat

25 free of twist and free of step discontinuities.

26

27 67. (new) The structure of claim 65 in which said lateral surfaces are faceted with flat

28